

with many metals, and carbonic oxide especially with iron. Whether this condition is rightly distinguished from ordinary chemical combination is a question which admits of debate. The stability of all dissociable compounds is influenced by pressure and by temperature in the same kind of way as "occlusion," which, like ordinary chemical combination again, is a phenomenon in which the bodies concerned exercise a power of selection.

The presence of hydrogen as well as carbon dioxide in granite, if already observed, is not known to geologists generally. From observation on variations in the critical point of carbon dioxide in minerals ('J. Chem. Soc.,' 1876, ii, 248), Hartley seems to infer that the incondensable gas present with carbon dioxide, is usually nitrogen. A passage in Geikie's 'Text Book of Geology,' third edition, p. 110, refers to the presence of hydrogen in cavities; but at present I have no information as to the evidence upon which this statement is based. The presence of hydrogen in such a rock as granite must be attributed to the existence of this gas in large proportion in the atmosphere in which the rock was crystallised. Whether this was the primeval atmosphere of the earth before the hydrogen had escaped or had been oxidised into water, or whether it resulted from the local action of water upon unoxidised metals or other materials in the interior of the earth, is a question which may be of some interest to the geologist. If the former hypothesis were adopted, it would perhaps be difficult to explain the absence of helium from the gas included in the rock; and, on the whole, I incline to the latter view, as affording the more probable explanation.

I have ascertained that hydrogen is present in even larger proportion in the granite from the neighbourhood of Dublin, and I propose to examine some other examples of the ancient crystalline rocks in order to determine the nature of the gases enclosed in them.

II. "On a Special Action of the Serum of Highly Immunised Animals, and its Use for Diagnostic and other Purposes."
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(Abstract.)

The following conclusions are the outcome of an enquiry into the nature and value of "Pfeiffer's reaction," which was made at the suggestion and under the guidance of Professor Max Gruber, of Vienna, to whom my best thanks are due. The present communica-

tion deals with the effects produced upon microbes *in vitro* by the serums of highly immunised animals, even when extremely dilute. This portion of the enquiry has been carried out mainly in the Bacteriological Laboratory of Guy's Hospital.

1. A remarkable series of effects are produced on an emulsion of actively motile microbes by the addition of minute quantities of potent kinds of serum.

2. These effects have been observed with the cholera vibrio, a variety of other vibrios, the typhoid bacillus, the *Bacillus coli communis*, and the *Bacillus pyocyaneus*.

3. It is highly improbable that the phenomena are limited to the groups and species here named. Further observation is requisite upon other motile, as well as the non-motile bacteria.

4. The most prominent of the effects thus produced consists of an immediate aggregation of the bacteria into "clumps"; this is combined with loss of motility. Marked inhibition of growth also occurs.

5. The formation of clumps can be detected readily by the naked eye. Eventually they gravitate to the bottom of the tube containing them.

6. A "complete action" is obtained when all the clumps settle down, leaving a perfectly clear fluid. The time required for settling varies somewhat with different organisms, as also according to the amount and potency of the serum used.

7. The least quantity of serum which will give a "complete reaction" in about one hour forms a convenient standard. A highly potent serum will react thus in 1 per cent. solution, which is a convenient unit.

8. The more intense the action of the serum the more rapid and the more complete are the changes which ensue.

9. By means of the intensity of action in varying dilutions, two or more samples of serum, or of freshly drawn blood, may be gauged according to their potency.

10. Normal serum, and the serum obtained by immunisations with totally unrelated groups of organisms, do not interact upon the unrelated microbes, so far as present observation shows.

11. The action of cholera serum upon more or less closely related vibrios may be "complete" or *nil*. A series of gradations in intensity of reaction has been observed with cholera serum and vibrios of other species, and *vice versa*.

12. The action of such serum cannot therefore be regarded as "specific"; it is better named *special* or *specialised*.

13. The limit of the absolute value of such serum tests for the diagnosis of cholera vibrios has yet to be determined.

14. All the typhoid bacilli from nineteen different sources hitherto

observed react with typhoid serum; none of them react with the *B. coli* serum.

15. Of the *B. coli* varieties hitherto proved, some do not react with one sample of *B. coli* serum.

16. The agreement in action of the typhoid bacilli points to the use of the method for diagnostic purposes. Given a young culture and typhoid serum, diagnosis can be made in a few minutes.

17. As shown by serum experiment, the variation within the *B. coli* group is greater than that of *B. typhi* races.

18. By the method described, more delicate changes can be observed than with such methods as plate cultivations, and the fallacies thereof are avoided.

19. A vibrio and a vibrio serum which will give a "complete reaction" *in vitro* will also give a positive result in "Pfeiffer's reaction" (e.g., *V. Iwánoffi* and *V. Berolinensis* with cholera serum).

20. It is not worth while performing Pfeiffer's test unless a "complete reaction" has been obtained *in vitro*.

21. In the method described, the whole series of changes, if any, are before the eye the whole time. In Pfeiffer's method the changes can only be seen by removing samples from their hiding place in the guinea-pig's peritoneal cavity. The extent of possible fallacy from using the peritoneal fluid of a living animal is not yet defined. Professor Pfeiffer himself admits that the animals vary to some extent according to their condition of health.

Dr. Klein described a new pathogenic anaërobic bacillus in man—*Bacillus enteritidis sporogenes*, an account of which is published in 'Centralblatt für Bakteriologie.'

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